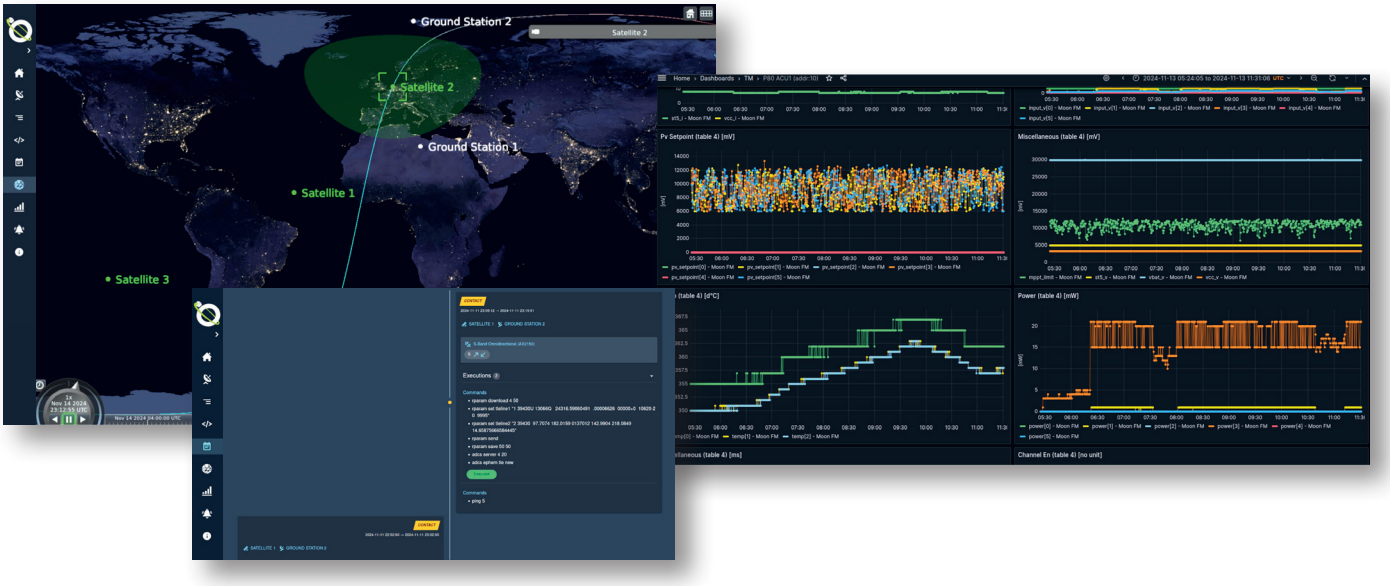

Ground Segment Solutions

GomSpace offers **NanoGround** and **Hands-off Operations Platform** (HOOP) products which can be used as ground segment building blocks for a wide variety of missions.

NanoGround enables spacecraft communication using GomSpace AX2150 and NanoCom Link S/SX radios for S- and X-bands, supporting TMTC and IP networking. It integrates seamlessly with commercial ground stations like KSAT, with AWS and RBC Signals support coming soon.

HOOP is a modular Mission Control solution for autonomous satellite operations. Pre-integrated with NanoGround, it supports any ground station or spacecraft, providing a ready-to-use option for GomSpace missions. HOOP is operational in three LEO missions, with five more underway.

Real-time telemetry monitoring and commanding

- HOOP allows operators to maintain situational awareness and manual, as well as automated operational control over spacecraft activities, while enabling seamless transition between automated and manual mission operations.
- HOOP provides real-time view of automatic execution of mission operation and a set of standard telemetry and telecommand dashboards providing a structured, user-friendly layout of essential mission data, making it easy for operators to monitor telemetry and status of telecommand sending and execution.
- To identify and analyze anomalies on spacecraft and ground, HOOP features flexible alerting system allowing alerts to be generated based on custom rules evaluated against telemetry parameters and any other monitoring data available in the system. In addition, standard set of alerts is provided for anomalies of automated operations and mission planning.
- HOOP supports mission-specific needs by enabling creation of tailored displays and alert configurations, ensuring that all unique aspects of the mission are effectively monitored and managed.

Event sequencing and automation

- HOOP streamlines execution of complex operations through pre-scheduling of activities, thus minimizing the need for manual interventions. HOOP Mission Planning engine allows automatic booking of contacts, planing and execution of in-contact and out-of-contact ground and spacecraft operations.
- The Mission Planning engine supports immediate telecommands for in-contact operations and time-tagged telecommands for out-of-contact operations. Operation automation can be tailored to mission-specific needs by writing mission-specific automation procedures for which HOOP provides convenient domain-specific procedure language. For missions using GomSpace platform, HOOP provides procedure and command sequences catalog for standard operations (such as routine operations, file transfers, operation over a point of interest, etc).

Ground Segment Integration and Communication Scheduling

- HOOP comes with in-built integration with the KSAT ground station network, providing S and X-band telemetry and telecommand (TMTC) links. This compatibility enables reliable communication with the spacecraft across various mission phases, leveraging KSAT's extensive network of ground stations.
- Additionally, the system includes the ability to automatically book contacts with ground stations, ensuring that communication windows are scheduled efficiently without requiring manual intervention. During these contacts, the system can also monitor antenna status in real time, providing operators with visibility into the availability and performance of each antenna to maintain uninterrupted mission support.

Flight Dynamics

- HOOP Flight Dynamics system is integral part of HOOP Mission Control solution, providing critical mission operation capabilities. The core feature of HOOP Flight Dynamics is orbit estimation and prediction, allowing accurate determination of spacecraft's orbit and prediction of its trajectory, enabling precise planing and scheduling of mission operations. Orbit prediction is a crucial capability within the HOOP Flight Dynamics system, enabling it to accurately determine both Ground Station contact windows and visibility windows for ground-based points of interest. This is essential for planning of ground station contacts, observations, data collection, or imaging activities, ensuring smooth mission operations.
- HOOP Flight Dynamics features high-fidelity environmental modeling, including high-precision model of Earth's gravitational field, gravitational perturbations, atmospheric drag, solar radiation pressure and space weather effects.

Wide range of deployment options

- HOOP offers flexible deployment options tailored to various operational and budgetary needs. For cost-effective on-premise deployment, HOOP is designed to run efficiently on minimal resources, requiring only 4 virtual CPUs and 16GB of RAM. This low resource requirement makes it feasible for smaller organizations, those with limited IT budgets or sensitive data governance policies, to host the system locally without significant infrastructure investment.
- Alternatively, for organizations seeking robust scalability and reliability, HOOP supports high-availability deployment in the Cloud through platforms like Azure or AWS. Utilizing Kubernetes for orchestration, the cloud-based deployment ensures continuous operation, fault tolerance, and automatic scaling to meet high-demand mission requirements. This dual deployment approach offers flexibility, balancing cost and performance based on mission needs.

Comprehensive system observability

- HOOP includes a system administration dashboard , providing administrators with a unified interface to manage and monitor system performance, configurations, and resources. This dashboard simplifies routine maintenance and enables quick access to critical settings and operational metrics.
- To support thorough oversight and security, HOOP also features centralized logs and events, allowing for comprehensive auditing of all system activities. By consolidating logs and event data, administrators can easily track changes, detect anomalies, and ensure compliance with security policies.

Open Interfaces

- HOOP is built with open interfaces to facilitate seamless integration with a wide range of external systems. It provides a REST API, based on the OpenAPI specification, enabling external systems to communicate with and utilize mission control functions directly.
- HOOP's integration with mission assets, such as spacecraft, ground stations, payload data ground segments, etc., is built on modular architecture, involving generic mission control core and a connector layer composed of mission- or protocol-specific adaptors. This approach allows HOOP to be adapted to a wide variety of spacecraft and ground stations.

Data Analytics

- HOOP integrates OpenSearch and Grafana, allowing the users to leverage full capabilities of both platforms and their ecosystems within HOOP. As a result, HOOP empowers users to perform in-depth data analysis and derive insights from data with minimal friction, making it a powerful tool for organizations focused on data-driven decision-making.

Security

- HOOP ensures robust security by implementing multiple layers of protection for data and user access. It supports HTTPS, enabling secure data transmission through the use of SSL certificates.
- For user authentication, HOOP integrates OAuth2 ensuring that only authorized individuals gain access to the platform. Additionally, HOOP offers flexible role-based access control with predefined roles–user, operator, and administrator–that can be customized to suit the specific security policies of an organization.